TECHNICAL INFORMATION ON BUILDING MATERIALS

FOR USE IN THE DESIGN OF LOW-COST HOUSING

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EXTERIOR WATERPROOFING FOR MASONRY

This is a digest of Research Paper RP771 (March 1935)[1] "Experiments on Exterior Waterproofing Materials for Masonry", by Daniel W. Kessler, issued by the National Bureau of Standards.

Purpose: To determine the effectiveness and durability of waterproofing treatments on masonry.

Materials used: Twenty-nine representative proprietary and ten non-proprietary treatments were applied in accordance with manufacturers' recommendations on limestone, sandstone, marble, brick, cast stone and mortar (1:3 cement and sand) and tested at intervals of 1 to 3 months over exposure periods up to 12 years.

The materials were grouped as follows:

Proprietary

(1) Thinned fatty oils
(2) Thinned fatty oils and paraffin
(3) Thinned varnishes
(4) Aluminum soap solutions
(5) Aqueous emulsions
(6) Wax solutions in volatile solvents
(7) Fluosilicate types
(8) Pyroxylin types

Non-Proprietary

(9) Aqueous solutions
(10) Molten paraffin
(11) Wax solutions in volatile solvents

As will be shown, compositions vary in effectiveness and durability; treatments are not equally effective on different pore structures; nor are they productive of waterproofing to the same degree with any given type of masonry.

[1] Obtainable from Superintendent of Documents, Government Printing Office, Washington, D. C. (Price 5 cents)

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In general, the more porous materials are more easily waterproofed and fine-pore structures are most difficult. Waterproofings should be adapted to pore structure rather than to types of masonry; adequate surface penetration is a very essential requisite.

Suitable treatment for any particular masonry is best determined by preliminary experiment with samples of material to be waterproofed. To determine effectiveness, penetration, and discoloration, rough dry fragments of masonry two or three inches in diameter should be weighed when dry, and after thirty minutes immersion in water, and the difference noted. After thoroughly drying the sample, applying treatment and again drying for two days, the difference in weight should again be taken between that in the dry condition, and after thirty minutes immersion. One coat of waterproofing should reduce the absorption weight by at least ninety percent.

Approximate penetration of waterproofing will be indicated by breaking the treated sample and dipping it in water. For common types of brick, limestone, and sandstone, penetration should be from one eighth to one fourth inch; for denser materials, one sixteenth inch should prove satisfactory.

For medium to coarse textures a very durable and economical treatment may be made by dissolving six to twelve ounces of high-melting-point paraffin to a gallon of solvent such as naphtha, gasoline, etc. For fine-pore structures, add three to six ounces of china oil to the gallon. All treatments should be applied only to dry masonry and in warm weather.

Discoloration can be best judged by comparing treated with untreated samples.

<u>Results</u>: Summary observations applying more particularly to results obtained as a group appear below:

(1) Thin fatty oil treatments were fairly satisfactory with medium textures but not adapted to fine or coarse types of masonry. Treatments of this group containing appreciable amounts of aluminum soap deteriorated rapidly when applied to limestone, suggesting possible saponification. Medium textured sandstones satisfactorily waterproofed showed a low rate of deterioration. Oily discoloration was produced.

(2) Fatty oils and paraffin in volatile solvents gave high waterproofing and durability values in most cases. Higher oil content was less effective on fine-pore structures; however, with such treatments consistency should be adapted to pore structure. Discoloration occurred to approximately the same degree as with thin fatty oils.

(3) Thin varnishes were not generally effective and showed a tendency to prevent the escape of absorbed water. Discoloration was excessive and more pronounced than with fatty oils.

(4) Aluminum soap solutions gave high initial waterproofing results, showing also a high rate of deterioration, effectiveness failing on an average at two years. Additions of small amounts of wax or oil increased durability slightly. Discoloration was slight.

(5) Aqueous emulsions of waxes and oils were generally unsatisfactory. Penetration was poor; the surface film discoloring and collecting dust.

(6) & (11) Paraffin in volatile solvents was effective and durable. Effectiveness on fine-pore structures was improved by addition of small quantities of fatty oils. Paraffin should have melting point above summer wall temperatures (135° F is satisfactory) to prevent flow from pores. Discoloration of an oily appearance is produced by this treatment.

(7) The fluosilicate treatments (magnesium fluosilicate or magnesium zinc fluosilicate) showed no waterproofing value.

(8) Pyroxylin types (cellulose nitrate, ethyl acetate, etc.) showed little penetration. The surface film weathered away in a short time, producing a glossy splotchy appearance.

(9) Two separate aqueous solutions (alum and potassium soap or sodium silicate and calcium chloride) applied separately, reacting with each other to produce insoluble precipitates gave generally poor results and showed tendency toward disintegration of masonry.

(10) Molten paraffin applied to surface, heated above that of melting point of wax (135° F or higher), gave very satisfactory results and excellent durability. Any surplus film of surface wax should be removed to prevent excessive discoloration and dirt accumulation.

General observations: Preservative value of treatments on small specimens of limestone and marble was observed and although not conclusive, showed that effective waterproofing appeared to retard common types of weathering deterioration. Other materials, including masonry, were not tested.

Destructive effects accompanying efflorescence and by the solvent action of rain water on limestone and marble were materially reduced by effective waterproofing treatments. There also were appreciable differences in surface appearances, those with durable treatments being smoother and usually cleaner.

Discoloration disappeared in most cases after a few months exposure with treated parts of lighter shade than those untreated. Specimens with durable treatments remained cleaner for several years.

Frost resistance appeared to be increased by effective waterproofing treatments although the experiments were too meagre to warrant final conclusions in this respect.